Physics 24 Problem Set 2

Harry Nelson

due Monday, Jan. 23 at 5pm

Course Announcements:
Read Chapter 6 of Purcell, sections 6.1-6.5. These correspond to RHK4 Chapters 34 and 35.

1. A wire lays in the $x-y$ plane (the z direction points up out of that plane) along the x-axis, from $-\infty$ to $+\infty$, and carries a current of 1 Ampere from $-x$ to $+x$. A charge $q = 2 \times 10^3$ esu is at $x = 0$, $y = 1\,\text{cm}$, and moves with speed, relative to that of light, of $\beta = 0.5$. Make a diagram showing (for each of the following cases) the velocity of the charge, the direction and magnitude of the magnetic field due to the wire at the charge's location, and the direction and magnitude of the Lorentz force on the charge.

   (a) When the direction of the velocity is in the $+x$ direction

   (b) When the direction of the velocity is in the $+y$ direction

   (c) When the direction of the velocity is in the $-x$ direction

   (d) When the direction of the velocity is in the $-y$ direction.

   (e) When the direction of the velocity makes a 30° angle above the x-axis, in the $x-y$ plane.

   (f) When the direction of the velocity is in the $-z$ direction.

   (g) When the direction of the velocity makes a 30° angle with the z-axis, in the $y-z$ plane.

2. Purcell 6.1

3. Purcell 6.2

4. Purcell 6.5

5. Purcell 6.7

6. Purcell 6.8